

# Mobile and Cloud based Public Participatory GIS (PP-GIS) Using Free and Open Source Software (FOSS)

A watershed TDET project sponsored by DoLR (GoI)



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# Contents

## 1. Software development

- PP-GIS: Simplify for use by village people
- FOSS: Android app, Quantum GIS plug-in, GeoServer
- Reasonable accuracy:  $\sim 3\text{m}-10\text{m}$   $\rightarrow$

## 2. Field Trials

- Two watersheds in A.P.

## 3. Capacity Building

- Four 5-day hands-on training workshops in A.P. and Odisha

## 4. Community Decision Support System (C-DSS)

- Under development

# PP-GIS: Simplify GIS for Use by Village People

Gathering field data using Android app



Free and Open Source Software

Mobile: **Android app**

Desktop: **Quantum GIS  
Plug-In**

Web: **GeoServer**



Preparing & Serving GIS maps  
using QGIS Plug-In & GeoServer WFS



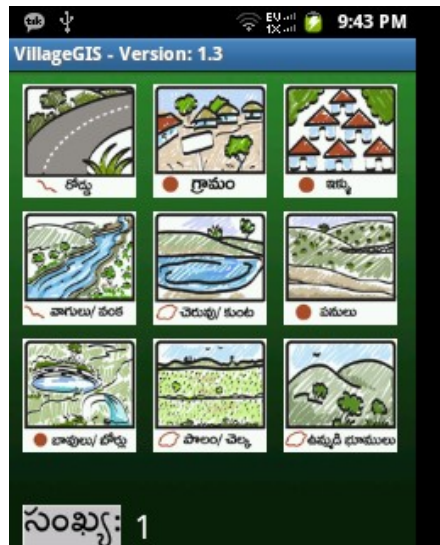
Planning and Monitoring  
using QGIS on village computers

# FOSS: Development & Release<sup>1</sup> of Mobile-&-Cloud-based GIS

## Cloud: GeoServer

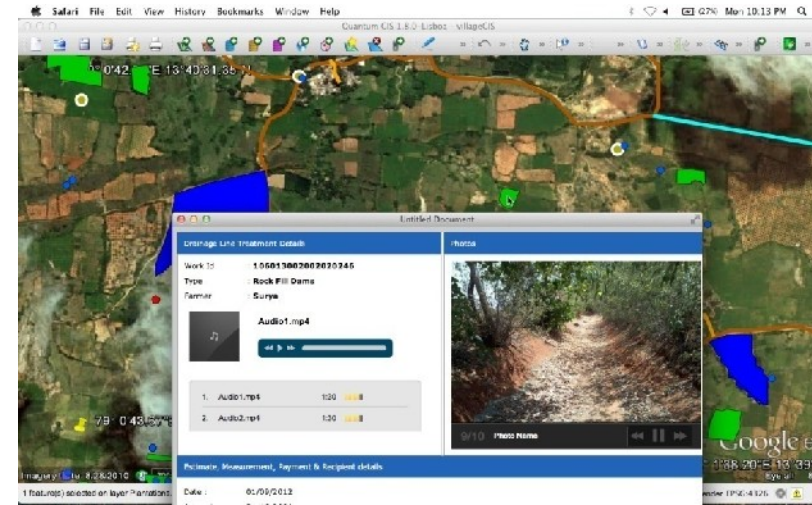
**QGIS plug-in:** zip file → GIS feature + data from MIS server

**GeoServer:** Serves map+data of works to clients



As Zip files

As WFS features



## Mobile: Android app

a. WA maps each work

GPS map, Photographs, Text (e.g. WorkId) & Audio-Video

b. Uploads to server as zip

2G or WiFi  
or BlueTooth

## Desktop: QGIS viewer

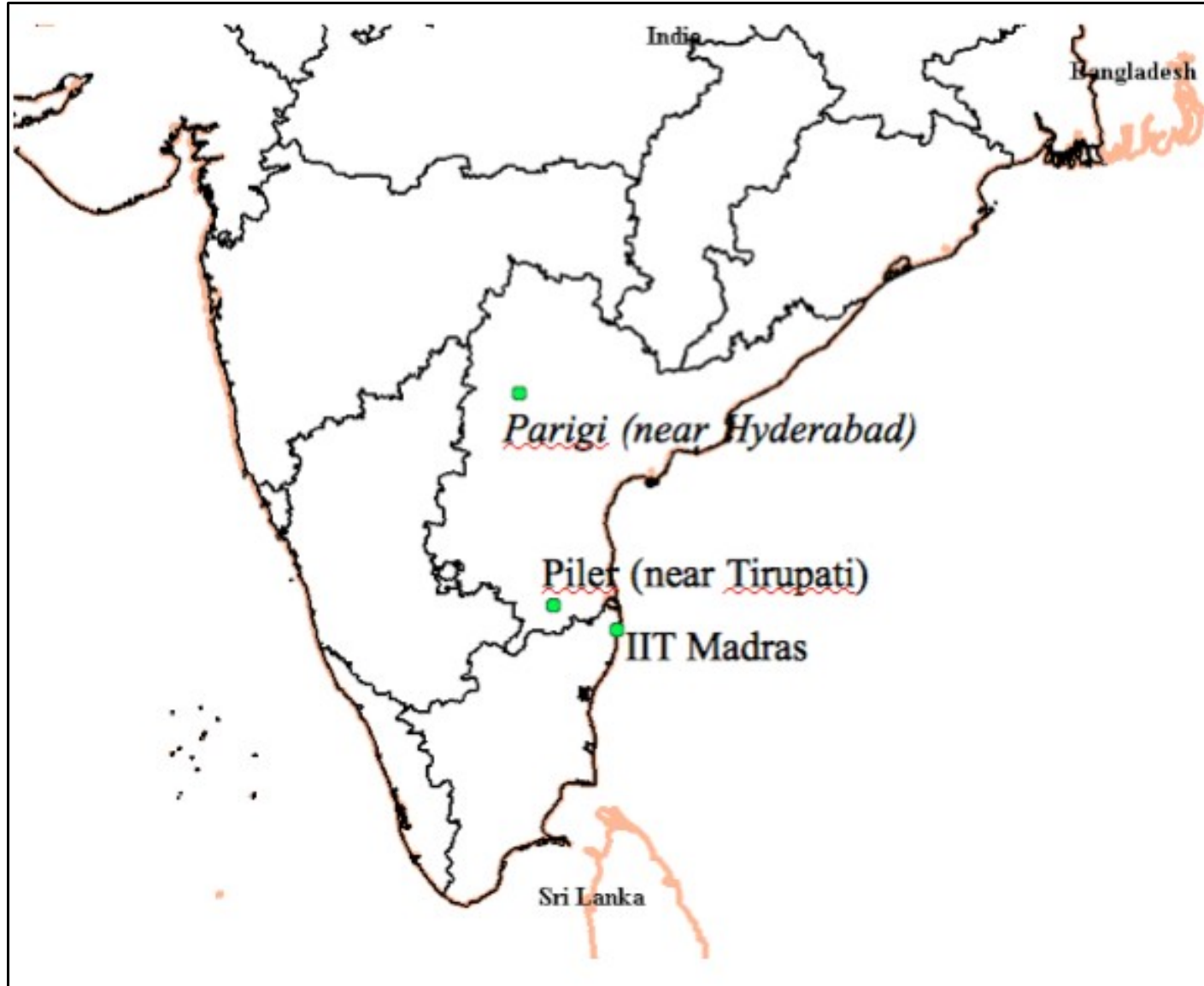
Shows over satellite data (Google, Bhuvan, etc) & base layers (custom HTML view)

For use by: Officers (**online**) & Community (**offline**)

<sup>1</sup>Free downloads from [iitm.ac.in](http://iitm.ac.in)



# Field Trials



**'GIS compliance score':** E.g. Micro watershed 1 (95%), etc.

Recommendation to IWMP: Make GIS compliance score compulsory

# Capacity Building Activities: 5-day Training Workshops



Piler WCC (GO), Chittoor dt. (AP)



Parigi WCC (NGO), RR dt. (AP)



Malkangiri dt. (Odisha): NGO network



Gajapati dt. (Odisha): University



# PP-GIS based C-DSS Leads to Better Decisions

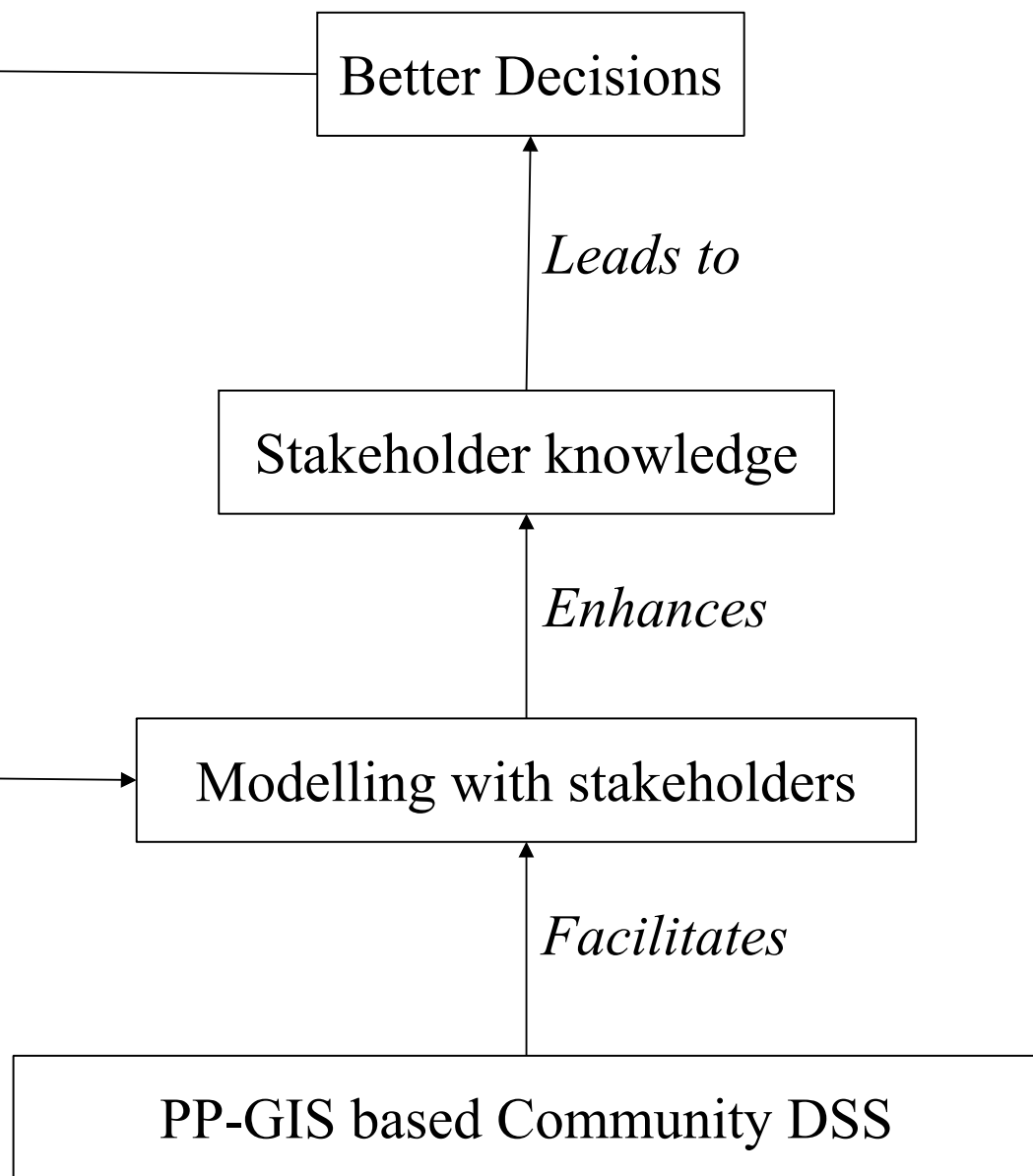


Irrigated Dry (ID) crops



Village-level discussions: 'Gram Sabha'

→C-DSS





# 'Better Decisions'



Constructing better structures



Maintaining existing structures



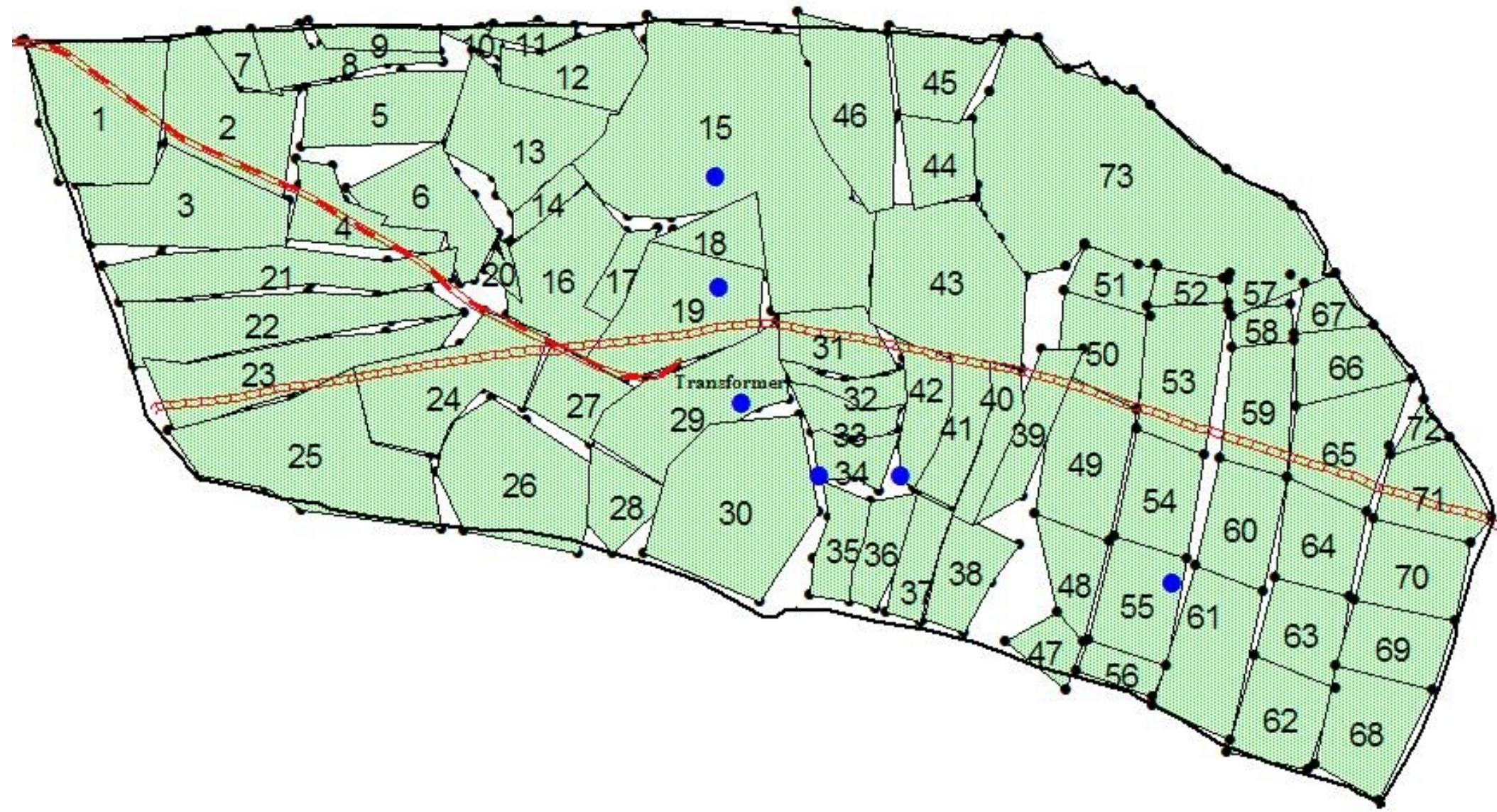
Protecting catchment forest



Switching to irrigated dry crops



# 'Better Decisions'



To promote moving towards locally appropriate solutions

→C-DSS

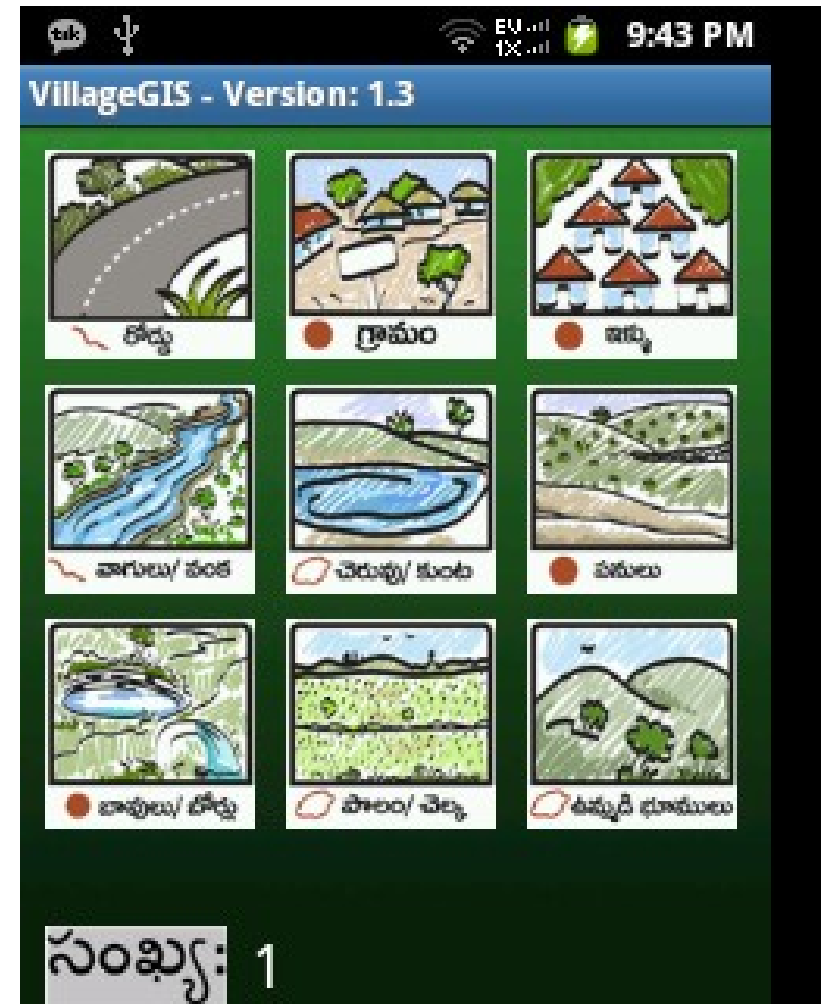
E.g. Bore Well Co-operatives

# **Android app**



# Step 1: Mobile: Android App

1. Select type<sup>#</sup> of feature to be mapped

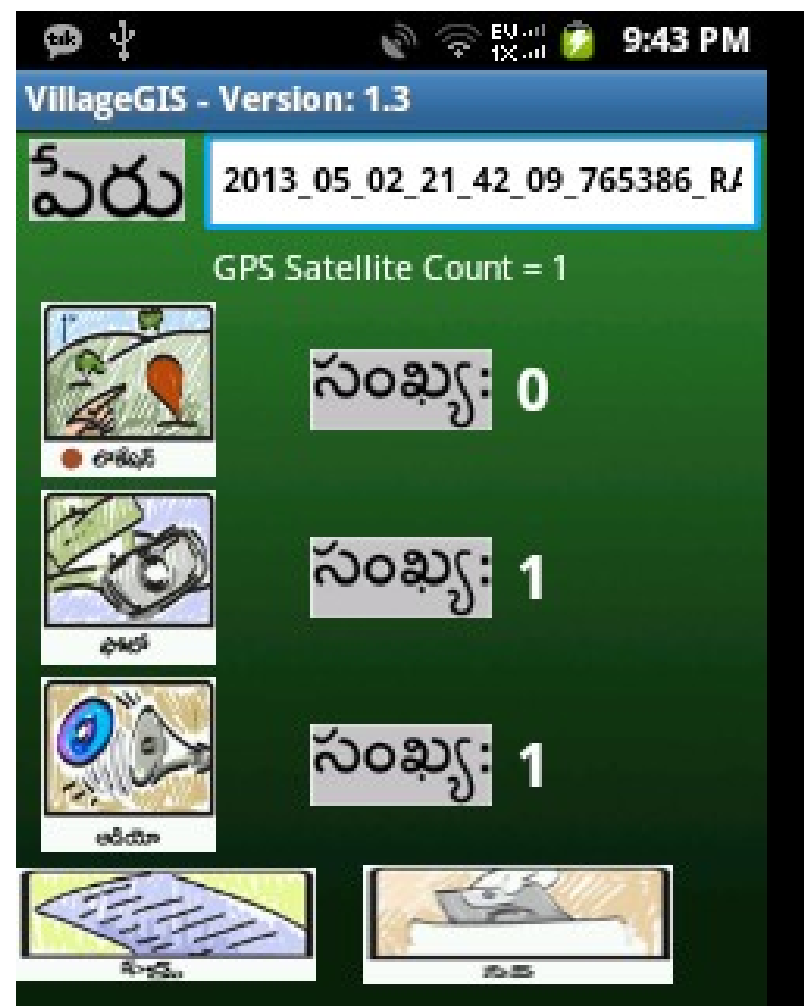


<sup>#</sup>Types of features supported:

- **Habitations & Roads**
- **Pre-existing works**
- **Works** (e.g. Proposed, Sanctioned, In-Progress and Completed)
- Tanks & Streams
- Commons
- *Wells & Farms*
- *Households*

# Step 1: Mobile: Android App

1. Select type<sup>#</sup> of feature to be mapped
2. Save GPS points and Photographs  
(time series)



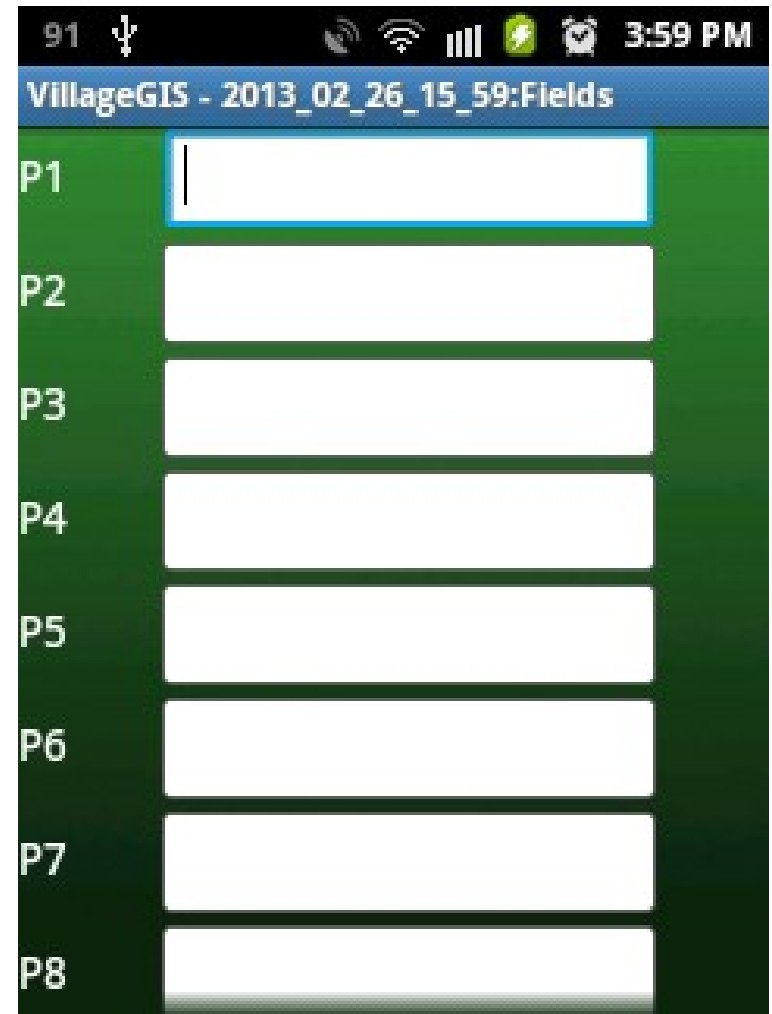
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# Step 1: Mobile: Android App

1. Select type<sup>#</sup> of feature to be mapped
2. Save GPS points and Photographs  
(time series)
3. Save text fields (e.g. Work ID)

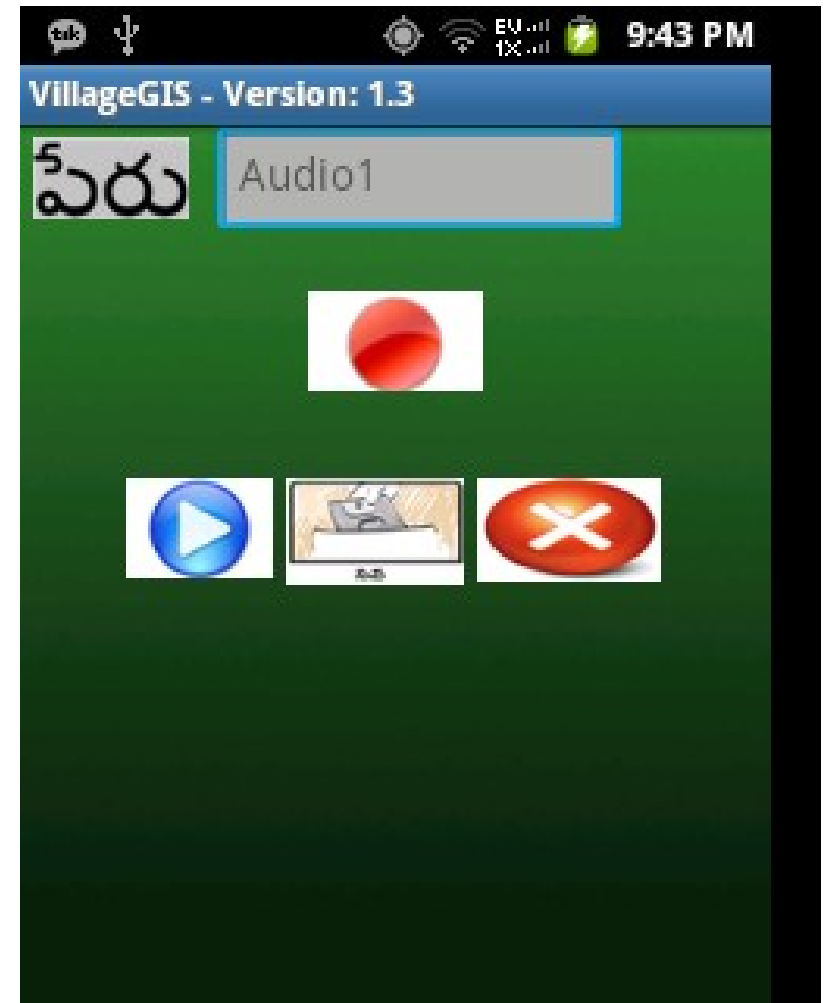


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- *Households*

# Step 1: Mobile: Android App

1. Select type<sup>#</sup> of feature to be mapped
2. Save GPS points and Photographs (time series)
3. Save text fields (e.g. Work ID)
4. Save Audio data (e.g. interviews, text fields, etc)



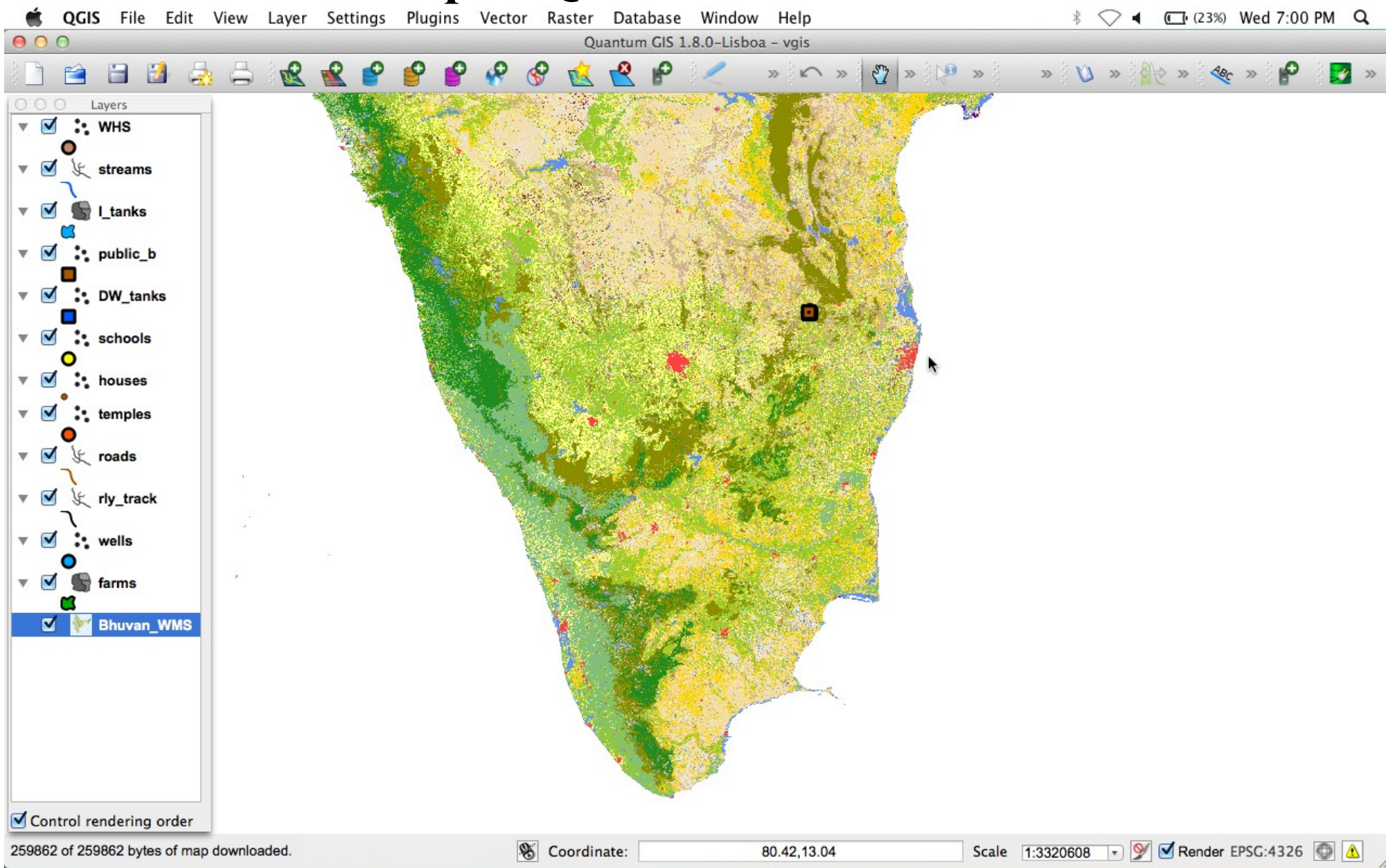
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# QGIS plug-in

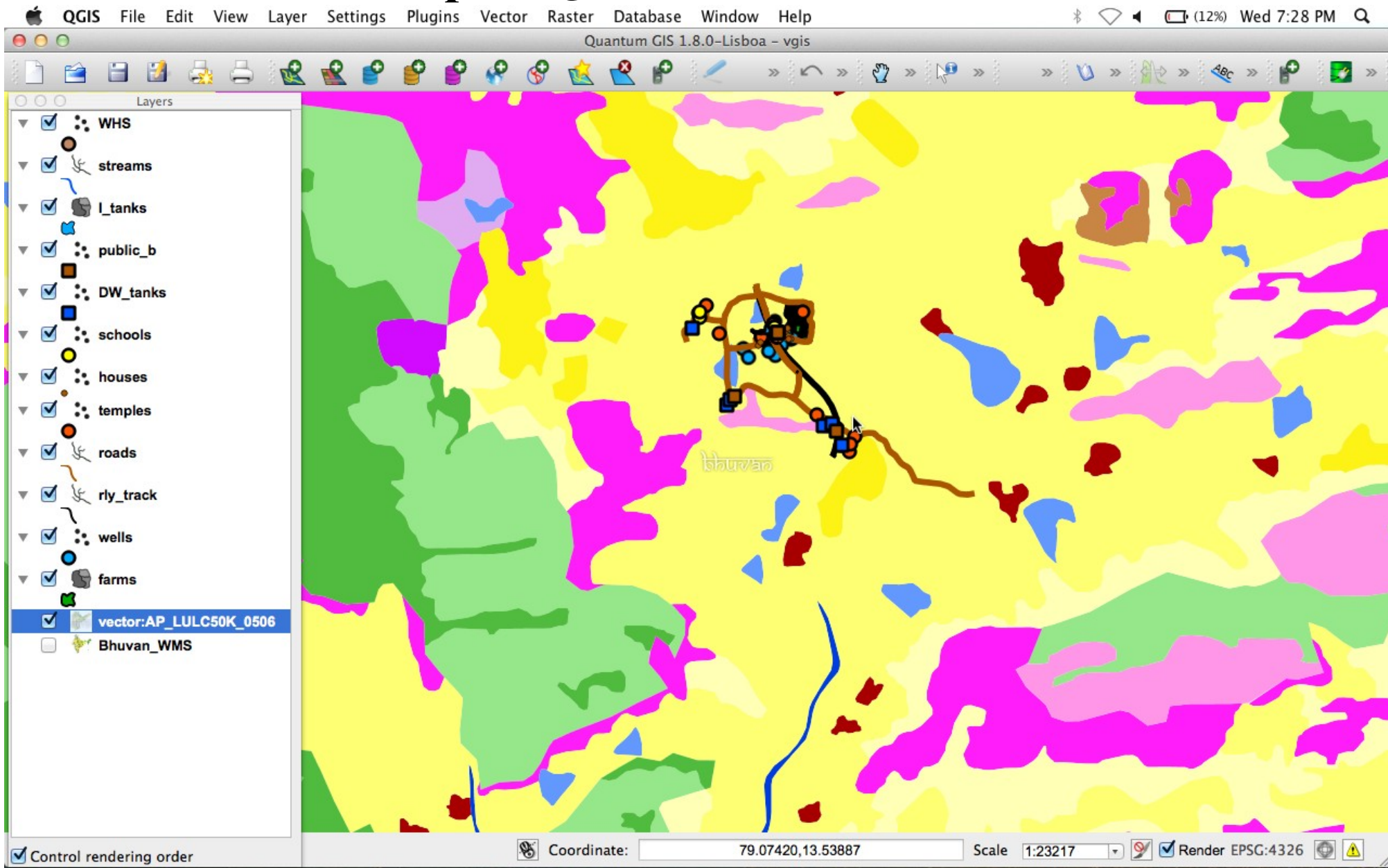
# Step 3: Quantum GIS Viewer



Shows time-series maps of works against Bhuvan/Google imagery and base layers



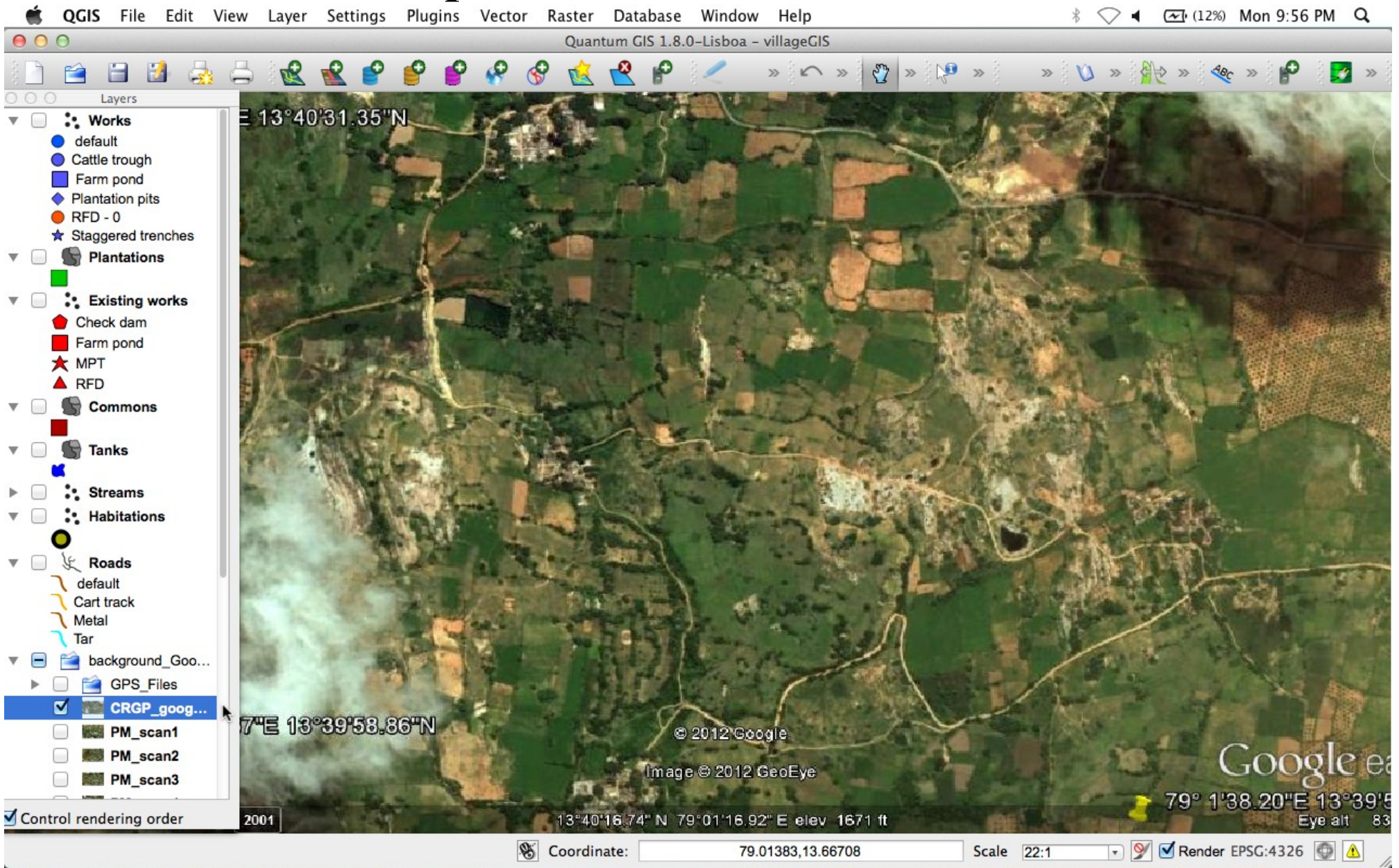
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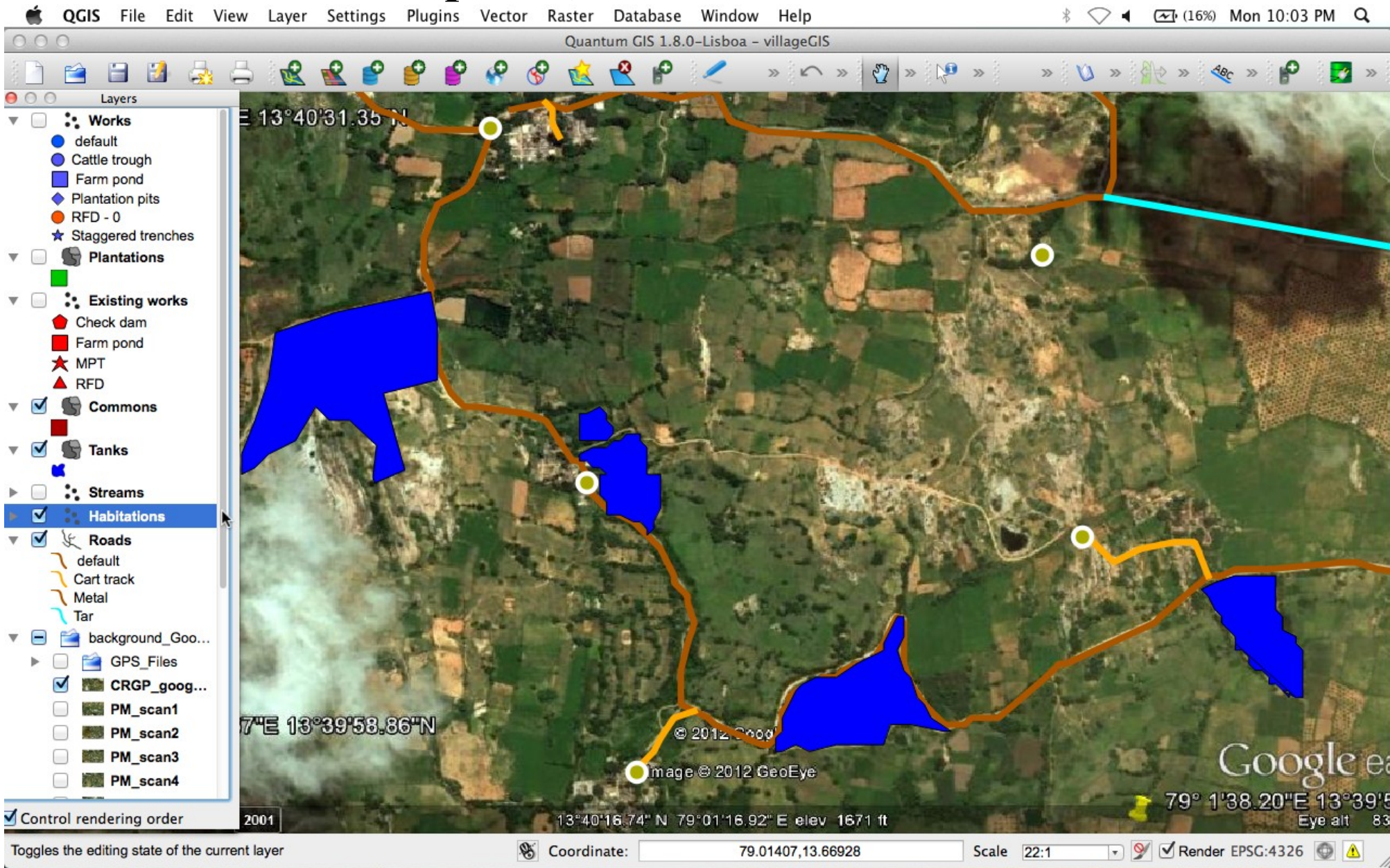
# Step 3: Quantum GIS Viewer



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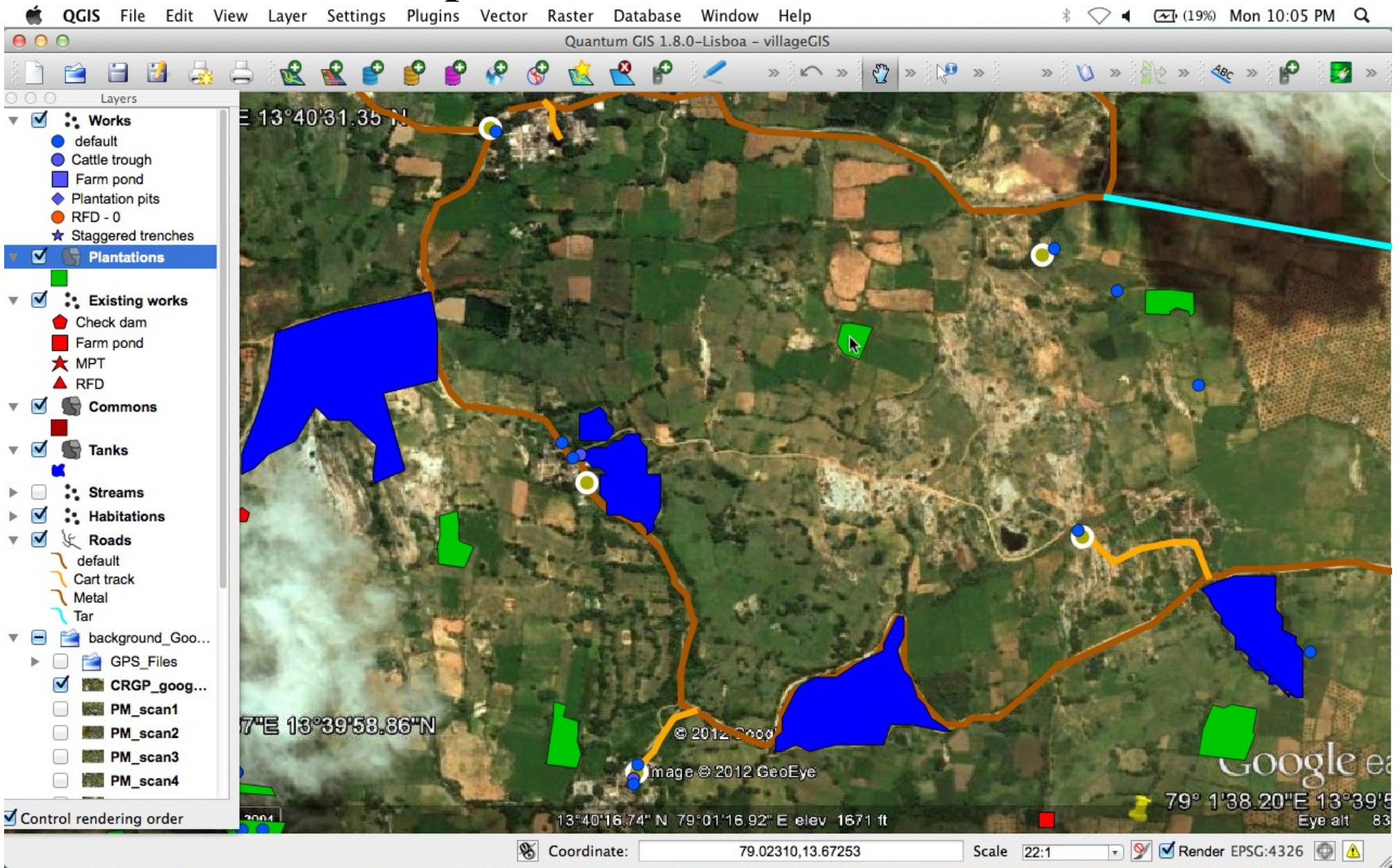
# Step 3: Quantum GIS Viewer



Shows time-series maps of works against Bhuvan/Google imagery and base layers



# Step 3: Quantum GIS Viewer



Shows time-series maps of works against Bhuvan/Google imagery and base layers





# C-DSS



# Need for GIS-based Watershed Planning

A well located farm pond



Wrongly located farm pond: No water



# Need for GIS-based Watershed Planning

A well located farm pond



Wrongly located farm pond: No water



Transect walks to locate & plan works



# Need for GIS-based Watershed Planning

A well located farm pond



Wrongly located farm pond: No water



Rare

Sl. No.	Name of work	Cost of work
1	Strengthening of Oddukatta tank bund and renovation of supply channel & cart track from Ragimanukunta to Oddukatta at E. Palaguttapalli panchayat in Pakala mandal, Chittoor dt., A.P.	69,142
2	Strengthening of Ragimanukunta tank bund and renovation of supply channel and cart track from Dalitawada lands to Ragimanukunta to at E. Palaguttapalli Panchayat in Pakala mandal, Chittoor dt., A.P.	33,048
3	Renovation of supply channels to Donabanda cheruvu at E. Palaguttapalli Panchayat in Pakala mandal, Chittoor dt., A.P.	20,820
4	Construction of Rock Fill Dam (R.F.D.) for breach closing on Vootla vanka to Sri Malleswara Swamy cheruvu near Babamma lands at E. Palaguttapalli panchayat in Pakala mandal, Chittoor dt., A.P.	5,012
5	Construction of Rock Fill Dam (R.F.D.) on Vootla vanka to Sri Malleswara Swamy cheruvu near Chandra Reddy lands at E. Palaguttapalli panchayat in Pakala mandal, Chittoor dt., A.P.	4,292
6	Construction of Rock Fill Dam (R.F.D.) on Vootla vanka to Sri Malleswara Swamy cheruvu near S. Rajagopal naidu lands at E. Palaguttapalli panchayat in Pakala mandal, Chittoor dt., A.P.	4,046
7	Construction of Check Wall on Vootla vanka to Sri Malleswara Swamy cheruvu near Raghunatha Reddy lands at E. Palaguttapalli panchayat in Pakala mandal, Chittoor dt., A.P.	44,763
	<b>Total:</b>	<b>1,81,123</b>

Transect walks to locate & plan works

Watershed plan: Without locations<sup>25</sup>



# Need for GIS-based Watershed Planning

A well located farm pond



Wrongly located farm pond: No water



↑ Result



Rare

Sl. No.	Name of work	Cost of work
1	Strengthening of Oddukatta tank bund and renovation of supply channel & cart track from Ragimanukunta to Oddukatta at E. Palaguttapalli panchayat in Pakala mandal, Chittoor dt., A.P.	69,142
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	<b>Total:</b>	<b>1,81,123</b>

Transect walks to locate & plan works      Watershed plan: Without locations<sup>26</sup>

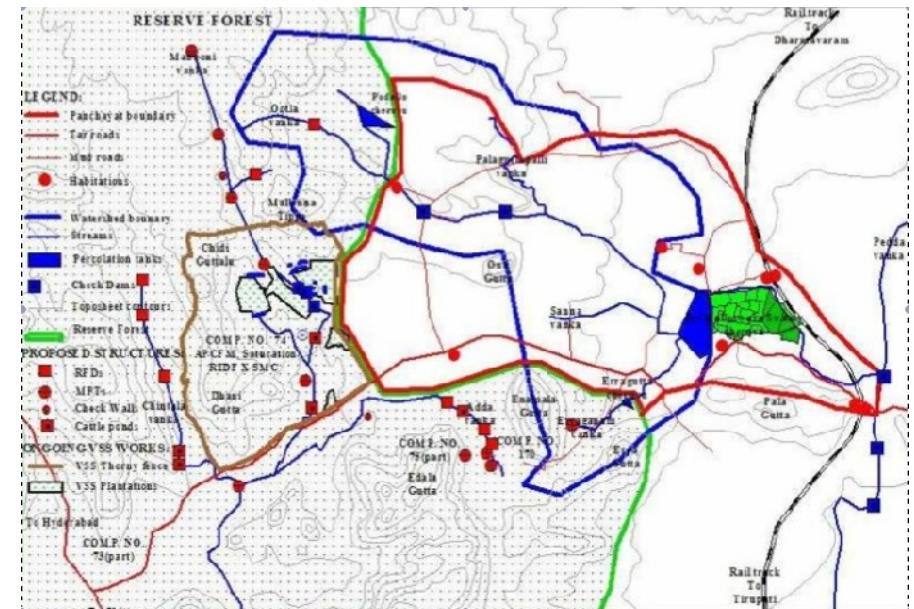


# Need for GIS-based Watershed Planning

A well located farm pond



Wrongly located farm pond with no water



Watershed plan: Using GIS 27







# Need for GIS-based Watershed Planning

A well located farm pond

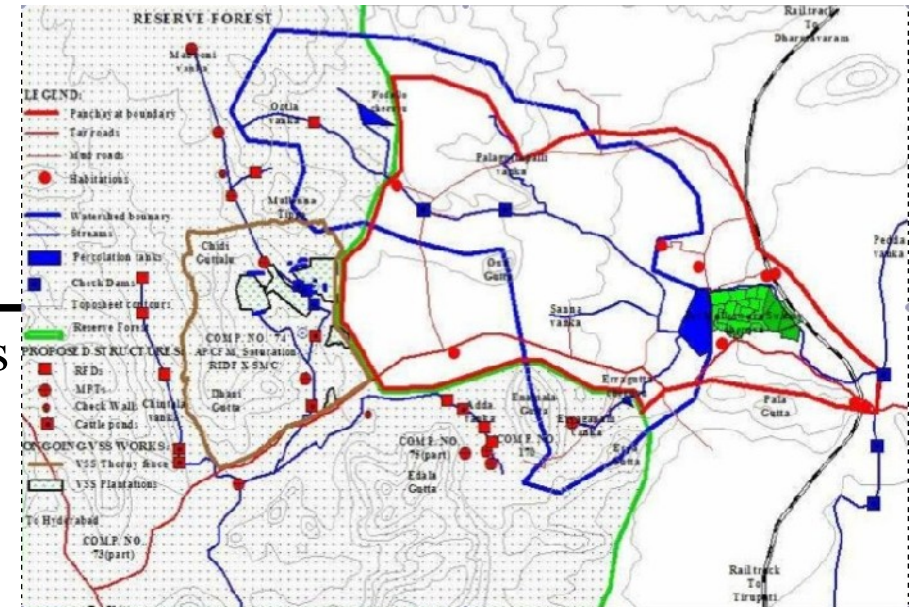
Wrongly located farm pond with no water



↑ Result



← Forces



Transect walks to locate & plan works

Watershed plan: Using GIS 29



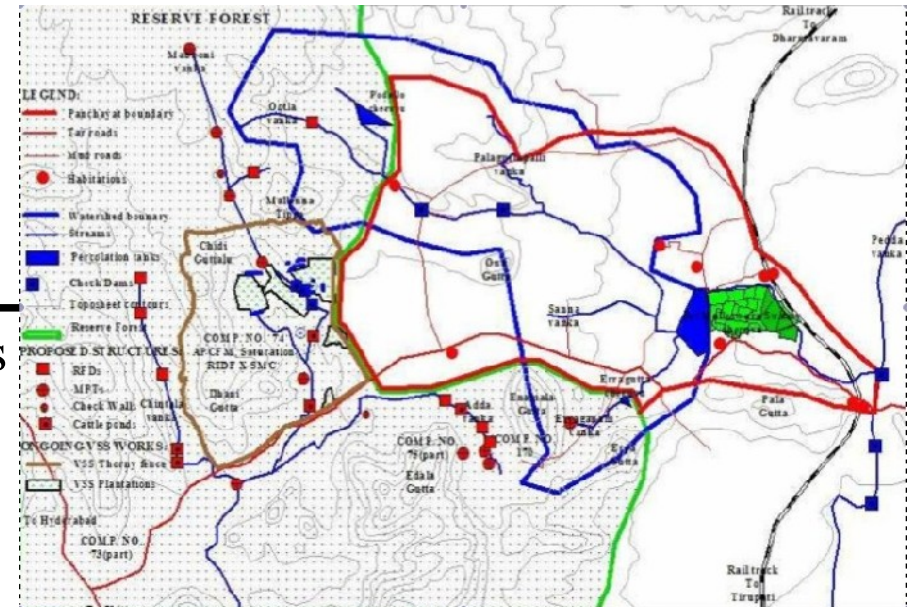
# Need for GIS-based Watershed Planning

A well located farm pond

Wrongly located farm pond with no water



↑ Result



← Forces

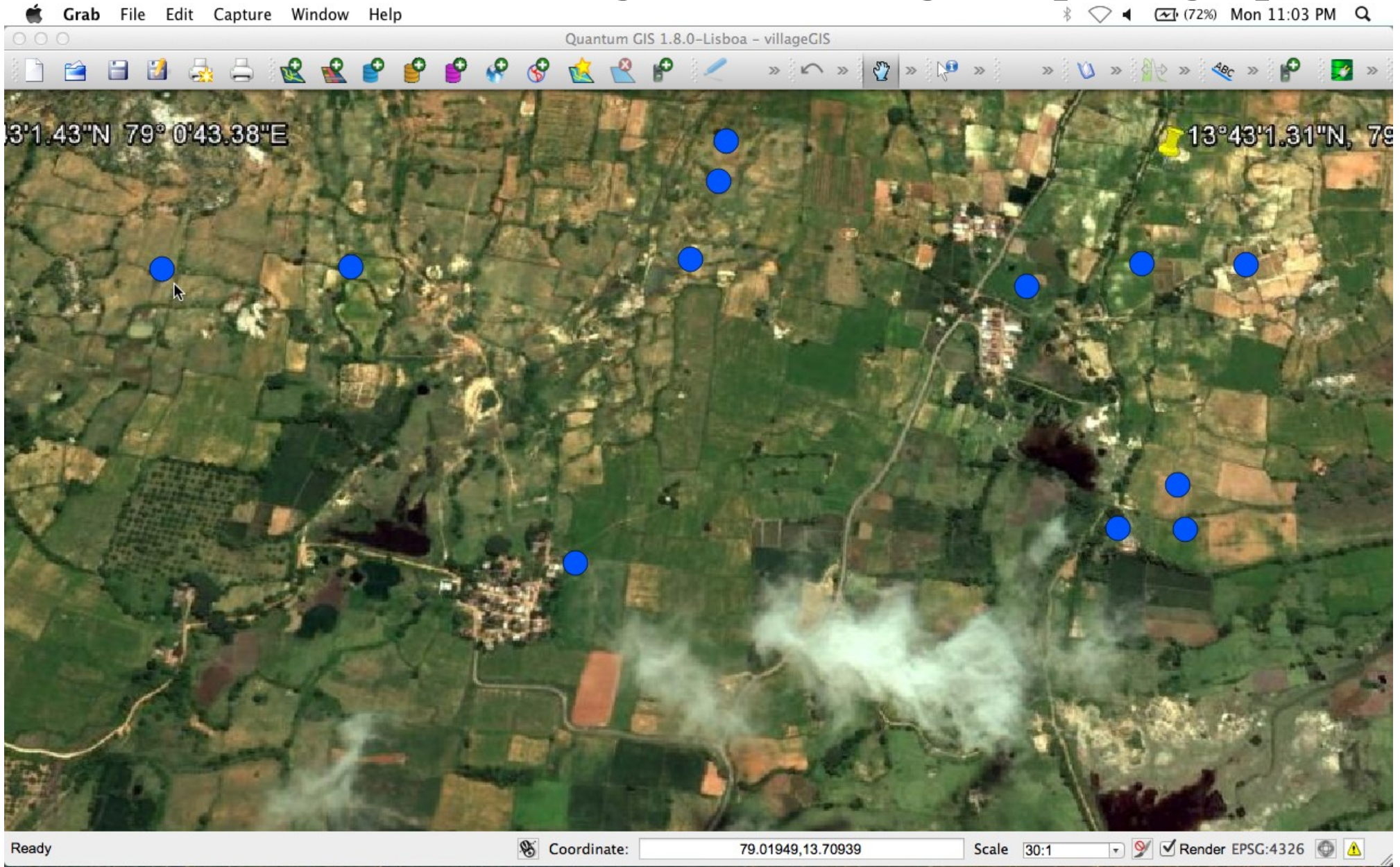
Transect walks to locate & plan works

Watershed plan: Using GIS <sup>30</sup>

**Solution: Simplify GIS-based watershed planning and make it compulsory**



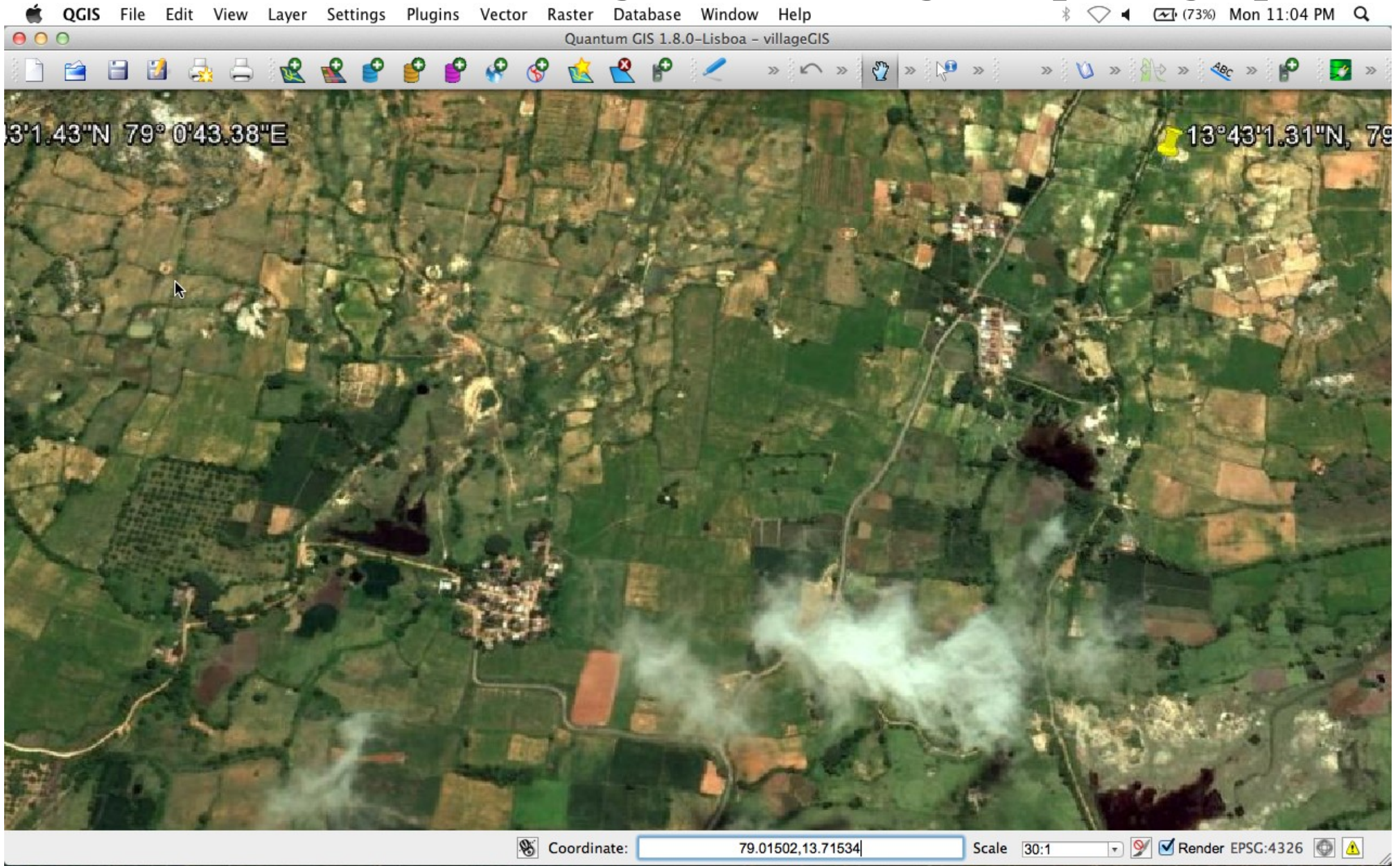
# To Monitor Works: Using satellite images & photographs



e.g. farm ponds



# To Monitor Works: Using satellite images & photographs



e.g. farm ponds



# To Monitor Works: Using satellite images & photographs

The screenshot shows the Quantum GIS 1.8.0 interface. The main map displays a satellite image of a rural area with a grid overlay. A red star icon is selected on the map, and its coordinates are shown as 13°1.43'N 79°0'43.38"E. The event browser window is open, showing a table with the following fields and values:

Field	Value
1_Photo	
2_Audio	
3_Video	
4_Doc	
A_WorkID	
B_Type	

The event browser window also displays a photo of a stone revetment structure. The photo includes the following metadata:

May 09, 2013 10:14 AM  
Lat: 13°42'55.9" N, Long: 79°0'53.5" E

The status bar at the bottom indicates "1 feature(s) selected on layer Works." and shows the coordinate 79.01516, 13.70973, a scale of 30:1, and the rendering engine set to EPSG:4326.

e.g. farm ponds: revetment should be ~1' below ground level <sup>33</sup>



# To Monitor Works: Using satellite images & photographs

The screenshot displays the Quantum GIS 1.8.0 interface. The main map area shows a satellite image of a rural landscape with a grid overlay. A blue circle and a red star icon are visible on the map. The coordinates 3°1.43'N 79° 0'43.38"E are shown in the top left corner. The Event Browser window is open, displaying a table with the following fields and values:

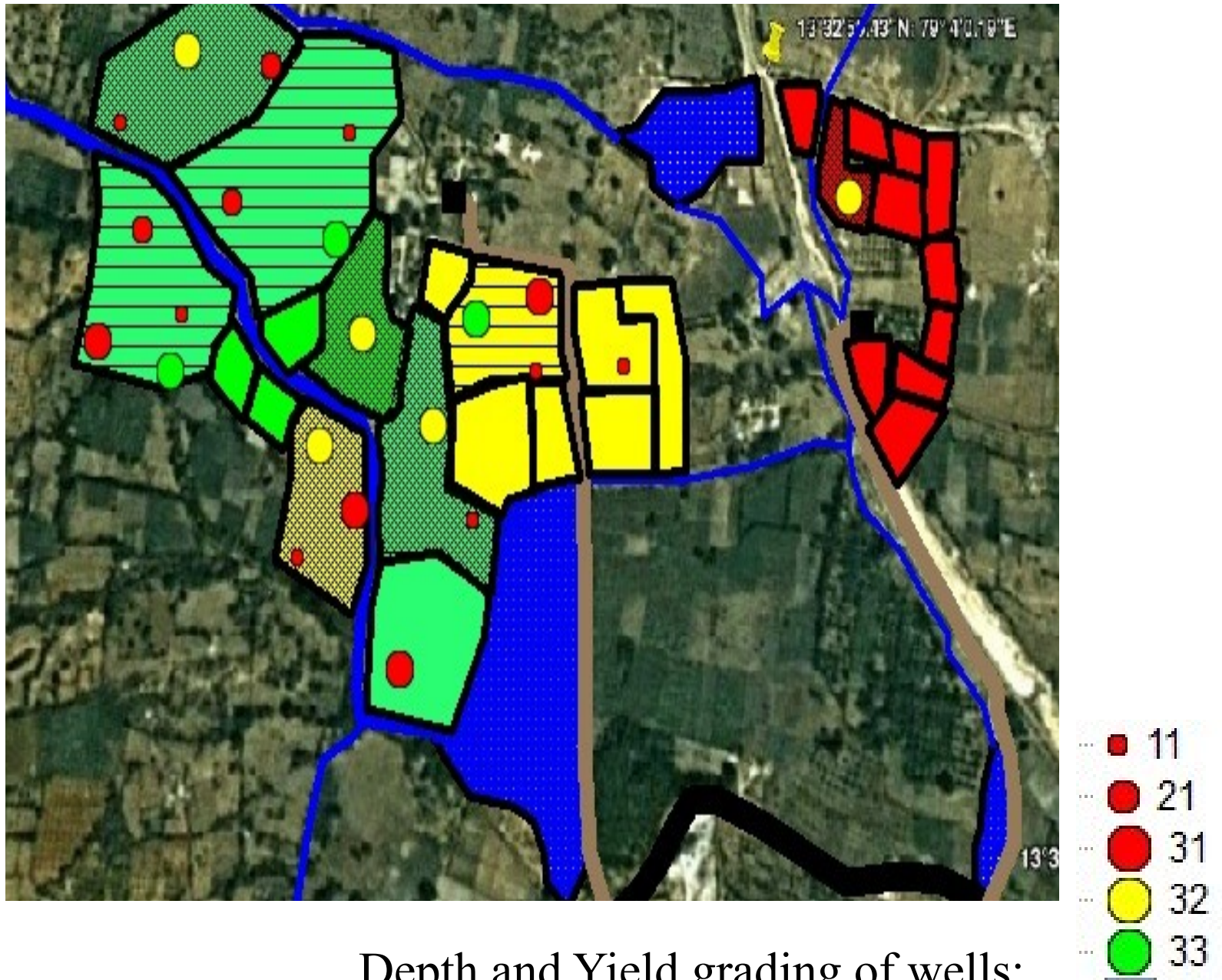
Field	Value
1_Photo	
2_Audio	
3_Video	
4_Doc	
A_WorkID	
B_Type	

Below the table, there is a video player showing a photograph of three people standing on a dirt path next to a large pile of earth. The interface includes a menu bar (Grab, File, Edit, Capture, Window, Help), a toolbar, and a status bar at the bottom showing "1 feature(s) selected on layer Works", "Coordinate: 79.01610,13.71009", "Scale 30:1", and "Render EPSG:4326".

e.g. farm ponds: scratch marks due to use of machines

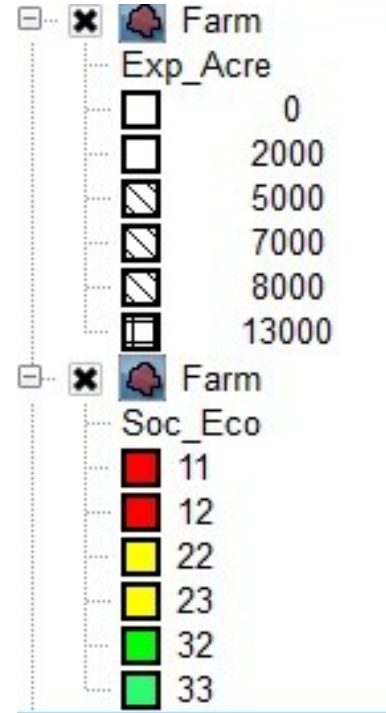
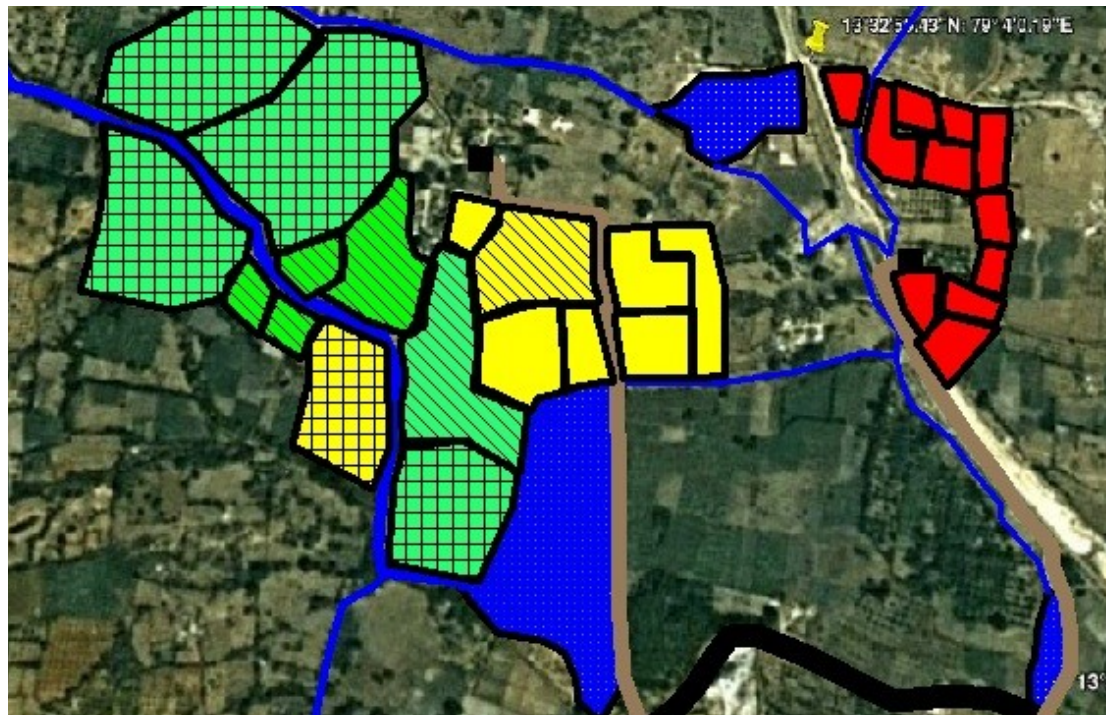


# To Monitor Effectiveness: Impact on water levels in wells

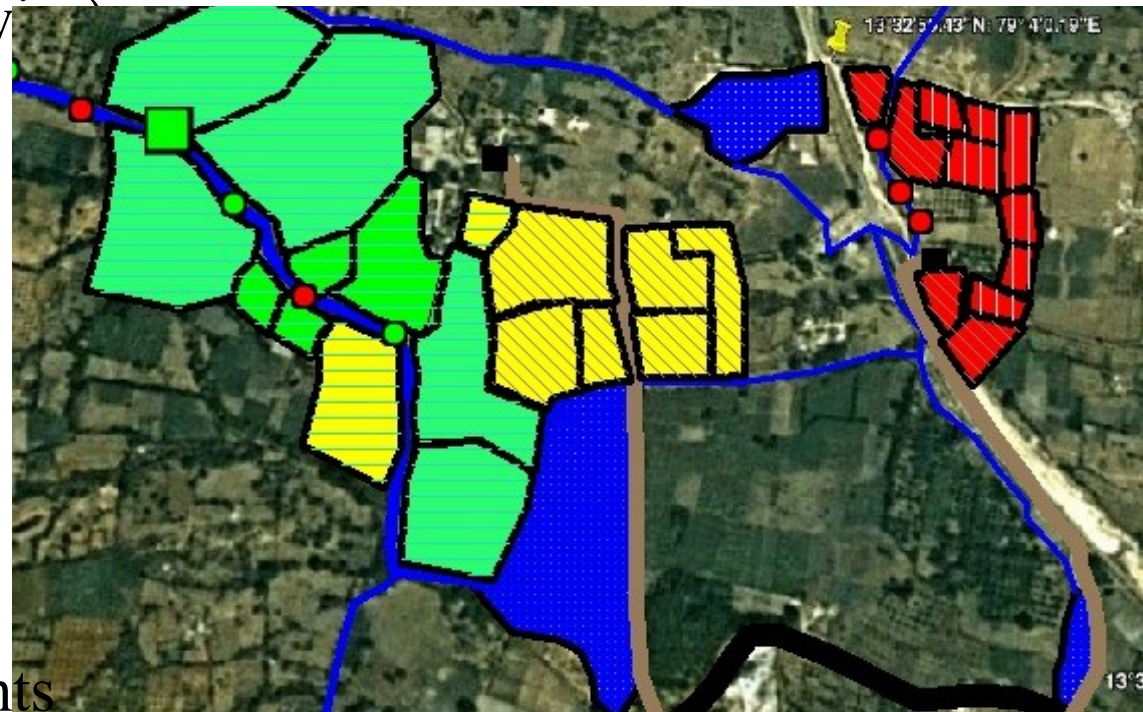




# To Monitor Equity: Across Socio-Economic & Spatial Groups



e.g. 1: Expenditure-per-acre (farm w/ )



e.g. 2: Slope; Drainage line treatments